LETTERS TO THE EDITOR.

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On the Colour of Sea Water.

AITKEN (*Proc. R. S. E.*, vol. ii. p. 472, 1882) has given a complete theory of the colour of sea water as observed at various places, based upon the principle that sea water is a blue liquid. According to this view, the green tint often observed in sea water, especially near land, is to be explained by the presence of fine yellow particles. During a recent voyage by the Messageries steamer *Polynesien*, I was permitted, through the kindness of Commandant Bullard, to erect a tube 736 cm. long against the rail of the after-deck, and to pass through it a continuous stream of water from the ship's salt water service. The water was taken in well forward and at a depth of two or three metres, and consequently was not soiled by the passage of the ship. I made a series of observations with the apparatus described, matching the colour of the sea water by making mixtures of definite substances, and using these mixtures to fill a tube 18 cm. long, placed alongside the water tube. Both tubes were illuminated by diffused daylight reflected from a white screen, and by the aid of diaphragms, &c., it was arranged so that the angular area of the visible part of the screen was the same whether observed through one tube or the other. Observations were made every day on the voyage from Sydney to Marseilles; but, owing to the uncertainty arising from the contamination of the water by the varnish with which the interior of the tube was protected, it is useless to comment on most of the results obtained, except in so far as they give a means of easily reproducing the exact tint of pure sea water as seen through a column 736 cm. long. Make up the following solution:—

Water, 500 c.c.
Soluble prussian blue, ·001 gram.
Saturated lime-water just precipitated by the smallest excess of bicarbonate of soda, 5 c.c.

This mixture, when viewed through a tube 18 cm. long, will show with considerable precision the colour of a sample of water from the Mediterranean, lat. 36° 24′ N., long. 17° 51′ E. of Paris.

By using various lengths of tubes I found that when a match has once been made, it can be preserved (within the limits tested) by increasing the amount of prussian blue proportionally to the length of the column of water under investigation. In these tests I made use of tubes 183 cm. long, which could be mounted in series; the relation held as the number of tubes was increased from two to five.

I consider that it would be worth while for a series of measurements to be made systematically by this method, and therefore mention that the tubes must be of black porcelain or glass; the water must be pumped by the observer's private pump (which must be worked off the electric service), and must give a pressure large enough for a Berkefeld filter. The colour of daylight is also too variable on the deck of a ship protected by awnings, and a form of artificial illumination should be employed. In making the colour matches, it is best to arrange to look down the two tubes simultaneously, using one eye for each tube. By slight squinting, it is easy to get the sensation of two patches of colour on the screen seen side by side.

The majority of the samples of water examined by me took 25 per cent. less blue to match them than the example quoted; and when the water was soiled by the tube, and perhaps at other times, it was necessary to add an amount of picric acid rising to a large proportion of the prussian blue, and, of course, giving a green solution. The transparency of the water is estimated by the amount of precipitated chalk it is necessary to add. At the same time, I am not sure that the loss of light observed, and requiring this addition to the match, is produced by turbidity. It is just as likely that the absorption spectrum of water is crossed by a faint but uniform band from end to end. In this case a black liquid might be added to make the match, but I do not know of one which is anything like black in very dilute solution; of definite materials the best was the aniline dye sold under the name of steel-grey, but it was very distinctly purple.

The water on the west and south-west coast of Western Australia is perhaps more interesting than any I have seen, for it is very green indeed, and very clear; so much so as to raise a doubt of the adequacy of Aitken's explanation, especially as the sand looks white rather than yellow. It is just possible that the sea may in certain places dissolve a sufficiency of yellow colouring matter from living or dead sea-weed to account for the green tint.

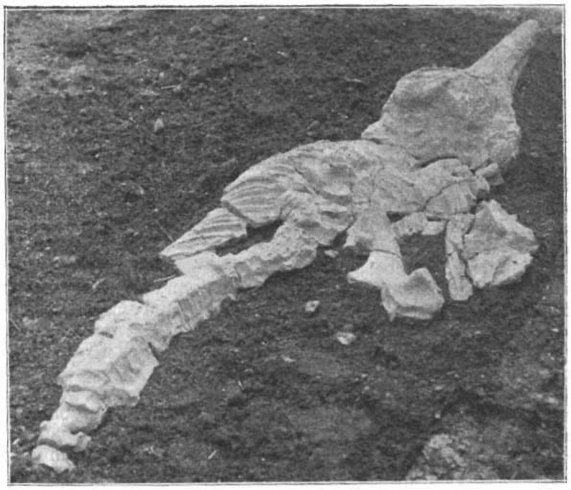
All the observations I made convinced me that the possible scattering of light by very fine particles in suspension has got nothing to do with the colour of the sea water.

RICHARD THRELFALL.

45 Frederick Road, Edgbaston, March 4.

Another Stockton Dragon.

SINCE we chronicled in NATURE in September last the find of an Ichthyosaurus in Mr. Lakin's pit at Stockton, the men in the neighbouring quarries have thirsted for the renown which a similar discovery would bring. Great care has been employed with the pick as each succeeding layer of clay was reached, and more than one false alarm has been raised. Last week a specimen less complete, but still remarkable, was unearthed in the cement works belonging to Messrs. Kay and Co. It lies 50 feet below the surface. The head is tolerably perfect, showing the teeth and one of the eyes. The ribs and paddles are much dislocated, and the lower part of the tail is wanting. The length of the head is 2 feet 8 inches, of the whole fragment 7 feet. It has been admirably photographed by Mr. Elkington, of Bradwell, Rugby, to whom we were indebted for the first monster, and who will supply copies to geologists and others requiring them. It is hoped that the fossil may be secured for the Warwick Museum.



W. T.

Chemists and Chemical Industries.

APART from any question of good taste, it was surely quite unnecessary for Dr. Armstrong to import personal matters into the discussion in which he takes part in his letter appearing in your issue of the 9th inst.

The causes of the relative positions of this country and Germany as regards chemical manufactures, whether due to the real or supposed laches of particular manufacturers or not, are due to national not individual failings, and were admitted so many years back that they have little interest to-day. Moreover, they were not under discussion.

The question was—Whether the best means were being taken to remedy admitted defects in view of the fact that our most successful rivals were demanding what they believe to be improvements in their own methods of producing industrial chemists.

With these words, I will leave my friend Dr. Armstrong's version of "Who drives fat oxen should himself be fat," and pass back to our subject.

I gather, then, that the real cause of the alarm in Germany

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is the energetic action of the Central Institution of the City and Guilds of London, &c. I frankly admit that I am rejoiced to hear it, and will thank God, therefore, though not in German, as is the way of superior people.

Some information on other points is, however, desirable to explain apparent anomalies.

For instance, why are we compelled, in Dr. Armstrong's phrase, to "expatriate our most capable students by Royal Commission?"

Why are the German laboratories so full of English and American students that names have to be taken in rotation, and in some cases instructions have had to be issued that preference is to be given to native students, and the number of foreigners limited?

Dr. Armstrong tells us that the education in "quite a number of our schools" is "even superior to that given in Germany." This is good news, and should soon attract—or perhaps it already has attracted—many students from Germany.

But, seriously, can one of our schools be named which, for building equipment and number of staff, is on a level with the best German examples?

Does Dr. Armstrong really mean to defend the use to which the education funds have been put by the counties and boroughs? Does he mean to say that the right persons have been charged with the duty of carrying on technical education? Does he think that a technical faculty could not be founded, or would have no value? Does he maintain that the sums spent—vast in the aggregate—have not been frittered away in teaching fragmentary science, &c., to people who do not need it?

If he says yes, then, regretting to differ, I must still maintain that while teaching as a rule has been, and is, too academical, the money would have been better employed had it been handed over to institutions such as his and Prof. Meldola's, for the purpose of founding technical faculties, for the erection of laboratories, and for the provision of more teachers in them, rather than in founding a host of places for teaching smatterings of science to artisans.

It seems to me to be a repetition of the errors of fifty years back. The originators of the "institutes" and "polytechnics" of the middle of the century made mistakes in a small way, and we are repeating them on a vast scale.

My critic says that this is not so, and that such a view gives an "entirely false impression."

I can only say that I heartily hope that I am wrong, for since no one has felt the opprobrium of the position more, no one will rejoice more if Dr. Armstrong's view is right.

In conclusion, may I add a word on Mr. Pope's letter in your issue of February 23. My withers are unwrung thereby, yet I can sympathise with those manufacturers who did refuse specimens. But there is another aspect of the question, than the easy acquisition of fine objects for the lecture table or laboratory museums for Mr. Pope, and those similarly placed, to consider, viz. the grave responsibility that a teacher incurs when he even seems to advertise the goods of any particular manufacturer. That is why such goods should always be purchased, and thus all obligation avoided.

R. J. FRISWELL.

March 11.

IN the current number of the *Berichte*, the following advertisement appears:—"Eine grosse Anilinfarbenfabrik sucht für das theoretische Laboratorium *gut geschulte Chemiker*. Praxis nicht erforderlich." Is not this a striking indication of the nature of the material from which the so-called "German technologist" is evolved, and of the methods by which Germany has attained so great a success in chemical industry?

WILLIAM A. DAVIS.

Central Technical College, Exhibition Road, March 11.

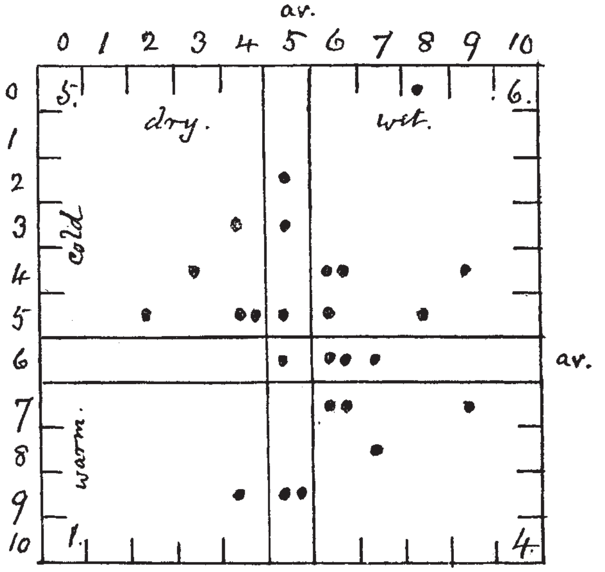
Sunspots and Weather.

I HAVE thought the following may be worth attention.

Count the number of *warm* months, and the number of *wet* months, at Greenwich, in each year, since 1841 (*i.e.* months above average in either case). Select the values in each of the five-year groups having a sunspot maximum year central; and the same with minimum.

This gives twenty-five numbers of warm months to be compared with twenty-five numbers of wet months, for sunspot *max.* groups; and like numbers for *min.* groups.

These may be compared by means of dots; using the ordinates for warm months, and the abscissæ for wet months. The average of warm months is six, that of wet months about five.



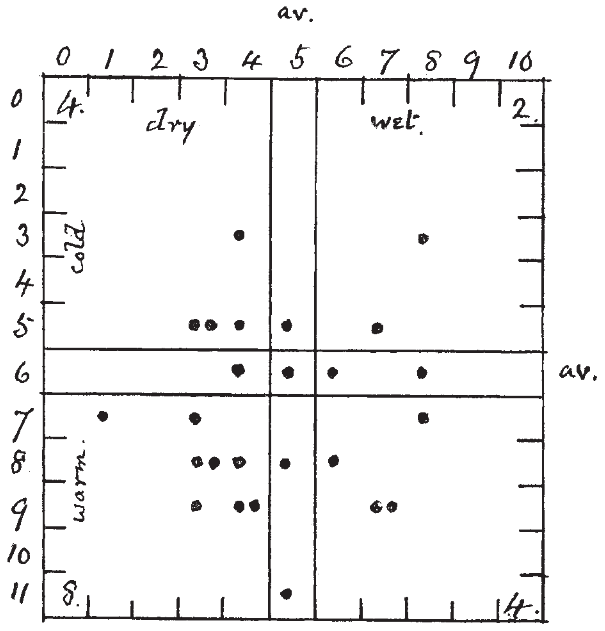
Minimum sunspot groups.

Cold and dry	5	Cold and wet	6
Warm and dry	1	Warm and wet	4

Totals—Cold, 14; warm, 7; wet, 13; dry, 6.

Some interesting contrasts come out.

Thus, in the *minimum* groups, there is only *one* year both warm and dry (1868); in the *max.* groups, *eight*. In the latter, only *two* years both wet and cold; in the former, *six*.



Maximum sunspot groups.

Cold and dry	4	Cold and wet	2
Warm and dry	8	Warm and wet	4

Totals—Cold, 7; warm, 14; wet, 8; dry, 13.

Compare, too, the total, cold, warm, wet, and dry, as at foot of diagram.

ALEX. B. MACDOWALL.

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